

Mass media nutrition information sources and associations with fruit and vegetable consumption among adolescents

Heinz Freisling^{1,*†}, Karin Haas² and Ibrahim Elmadfa¹

¹Department of Nutritional Sciences, University of Vienna, Althanstrasse 14, 1090 Vienna, Austria: ²Department of Health, Nutrition and Dietetics, Bern University of Applied Sciences, Bern, Switzerland

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Abstract

Objective: The objective of the present study was to examine associations between exposure to nutrition information as covered in mass media and daily fruit and vegetable (FV) consumption among adolescents.

Design: Cross-sectional nutrition survey.

Setting: Vocational schools in Vienna, Austria.

Subjects: A sample of 2949 ethnically diverse adolescents with mean age 17·3 (SD 1·7) years. An FFQ was used to assess usual FV consumption. Data on mass media exposure and sociodemographic characteristics were collected by means of a self-administered questionnaire. Multiple logistic regression analyses were used to control for potentially confounding variables.

Results: Adolescents who reported exposure to nutrition information provided by booklets, the Internet or newspaper articles were more likely to eat FV daily. For example, the OR for daily fruit consumption (OR_{fru}) was 1·6 ($P < 0·001$) when exposure to the Internet was reported after adjustment for age, gender, ethnicity, BMI and salary. No such associations were found for radio, television and magazines as sources of nutrition information. A negative impact on daily FV consumption was found for exposure to radio commercials (OR_{fru} = 0·74, $P = 0·04$ and OR_{veg} = 0·67, $P = 0·03$). Exposure to TV commercials had a negative impact on vegetable consumption (OR_{veg} = 0·81, $P = 0·05$).

Conclusions: Newspaper articles, the Internet and booklets as a source of nutrition information are positively associated with daily FV consumption among adolescents, whereas radio commercials have a negative impact. Dissemination of 'healthy eating' slogans should make use of print media and the Internet.

Keywords
Mass media
Nutrition information
Fruit and vegetable consumption
Adolescents

Daily fruit and vegetable (FV) consumption, in an adequate quantity (at least 400 g/d for individuals), is recommended to reduce the risk of CVD and various forms of cancer^(1,2). FV consumption is promoted in Austria mainly through food-based dietary guidelines (FBDG), including the '5-a-day' programme⁽³⁾. However, national dietary surveys indicate that Austrian population groups, particularly adolescents, fail to meet recommended intake goals for FV. The Austrian Nutrition Report 2003 revealed a mean daily intake of FV of 145 g and 78 g, respectively, among adolescents aged 15–18 years⁽⁴⁾.

Various personal and environmental factors are described that influence FV consumption among children and adolescents, including exposure to mass media as part of the social environment⁽⁵⁾. Today's young people spend up to 6·5 h/d using a combination of various media, such as television (TV), radio, the Internet,

magazines and others⁽⁶⁾. Exposure to mass media may have a considerable impact on eating habits in youth. The Health Behaviour in School-Aged Children survey showed that TV viewing seems to be associated with a lower FV consumption and a higher consumption of sweets and soft drinks among European 11–15-year-old children⁽⁷⁾. In a prospective observational study from the United States, one additional hour of TV viewing per day was associated with a decrease of 0·14 servings of FV per day among students (6th and 7th grade) from public schools⁽⁸⁾. Food advertising is one factor thought to be associated with eating habits in young people. A review of the literature reported that children exposed to food advertising will choose advertised foods at significantly higher rates than children who were not exposed⁽⁹⁾. A study that assessed associations between exposure to healthy and unhealthy foods on TV commercials reported a weak positive relationship between exposure to fruit and vegetable TV commercials and reported consumption among European schoolchildren⁽¹⁰⁾.

† Current address: Dietary Exposure Assessment Group, International Agency for Research on Cancer, Lyon, France.

*Corresponding author. Email heinz.freisling@univie.ac.at

Besides being a major channel of food marketing and advertising, mass media plays also an important role as a source of nutrition information.

A pan-European survey among adults, which included also adolescents and young adults between 15 and 24 years, reported that the top sources of nutrition information are TV/radio (29%), magazines (27%) and newspapers (27%). Other top sources are health professionals (26%), food packages (22%) and relatives/friends (22%)⁽¹¹⁾. Nearly three quarters of American adults (18 years and above) reported the mass media as their top source of information on health and nutrition⁽¹²⁾. A recent survey from Germany reported that mass media are top sources of nutrition information among adolescents and adults (aged 14 years and above), with newspapers/magazines as the top source (56%). TV is named by about 51%, followed by advertisements, radio, books, brochures and professional journals (between 36% and 32%)⁽¹³⁾.

Little research has been reported on the influence of exposure to nutrition information, covered in mass media, on eating behaviour.

In the present study, a simplified model of consumer research was used as a theoretical framework to analyse effects of exposure to nutrition information on consumer behaviour. In short, only nutrition information to which consumers are (frequently) exposed to may have an effect on their behaviour. Although the probability of exposure is increased when consumers actually search for the information, active search is not necessarily needed for exposure, which can also be incidental (e.g. food advertising). Subsequent behaviour may be affected when the information is perceived, either consciously or subconsciously, with stronger effects when perception happens consciously. If perception leads to understanding and liking of the information, the message may finally be used in making choices⁽¹⁴⁾.

The aim of the present study was to examine associations between exposure to nutrition information, as covered in mass media, and FV consumption among adolescents. Specifically, the following nutrition information sources were examined: TV, radio, newspapers, magazines, the Internet and booklets. To compare effects of exposure to nutrition information sources other than mass media, information provided in school and by relatives/friends was also examined.

Methods

Subjects

A total of 3377 adolescents in vocational training in Vienna, Austria, were enrolled in the present cross-sectional survey. After compulsory school, which is 9 years of schooling in Austria, adolescents have the possibility to start a 'dual' training ('apprenticeship') to be trained for skilled workers, usually in a crafts enterprise. This training

also comprises attendance of a part-time vocational school, which provides general education and theoretical background for company-based work. This dual training lasts between 2 and 4 years with at least 8 weeks of vocational schooling per year. Those adolescents usually have lower socio-economic backgrounds and are characterised by riskier lifestyles (e.g. high alcohol and tobacco consumption) than their peers attending high schools, and are, thus, a special target group for lifestyle interventions, including diet.

Cluster sampling was used to obtain a representative sample of the target population, where vocational school classes in Vienna were used as sampling units. Of the twenty-seven schools invited, twenty-two gave their consent for the study. All subjects of the selected school classes were then invited to take part. Parents of participating adolescents as well as the adolescents themselves gave their informed consent prior to participation. The final participation rate was 87% (*n* 2949). The study was conducted according to the rules of the Austrian ethics committee.

Measures

Data were collected by means of questionnaires administered in the classrooms, which the subjects completed independently under supervision of two trained nutritionists.

Sociodemographic data included information on age, gender and ethnicity. Ethnic origin was defined on the basis of subjects' responses to an open-ended question regarding their first language. Responses were recoded into two categories (0 = German-speaking/Austrian; 1 = otherwise/non-Austrian). Salary ('apprentice wage'), which is determined by the professional guild, was asked in five pre-defined categories ranging from 'less than 300 Euros' to 'more than 750 Euros' per month (see Table 1).

Exposure to nutrition information sources was assessed, by asking subjects where they usually obtained their information about nutrition. Common nutrition information sources were pre-defined (multiple responses were allowed); in addition, one open-ended response category, 'other source' was given.

Frequency of eating FV was measured by means of a qualitative FFQ. The food list has been developed on the basis of previous open-ended food consumption surveys in Austrian adolescents (I Elmadfa and B Zarfl, unpublished results), where the most informative foods in terms of amounts and frequency of consumption as well as contribution to intake of energy and nutrients have been included in the FFQ. Foods having essentially the same analytical values were aggregated into fifty-nine groups. The main group of FV contained seven subgroups, including fruit 'fresh', stewed fruit, vegetables 'raw and cooked', salad, pulses, potatoes 'boiled' and potatoes 'fried'. The self-administered FFQ asked about usual frequency of consumption of the fifty-nine food items during the previous months and provided ten

Table 1 Sociodemographic, anthropometric and lifestyle characteristics of the study sample (*n* 2949)

Characteristic	Mean	SD
Age in years	17.3	1.7
BMI in kg/m ²	21.6	3.3
Age in years, range	14–23	
	<i>n</i>	%
Girls	1423	48
Austrian	2167	74
Salary per month in Euro		
Less than 300	300	10
300–449	1163	40
350–599	816	28
600–749	351	12
More than 750	268	9
Daily fruit consumption	994	34
Daily vegetable consumption	661	23
Daily smokers	1897	64
Daily TV viewing*		
Less than 1 h	555	19
1 to <2 h	1092	38
2 to <4 h	813	28
4 h and more	439	15

*Including personal computer use.

frequency categories ranging from 'never' to 'more than once a day'. Responses to the two items 'fruit (fresh)' and 'vegetables (raw and cooked)' were recoded into dichotomous variables (0 = less than daily; 1 = at least daily).

In order to roughly estimate sedentary behaviour, subjects were asked how many hours a day they usually spend in front of the TV or personal computer. Response categories were pre-defined with four categories ranging from 'less than one hour per day' to 'more than 4 hours per day' (Table 1).

Smokers were defined as smoking at least one cigarette per day.

For the 2853 subjects who reported their body weight and height, the BMI was calculated (weight in kilograms divided by the square of height in metres).

Statistical analyses

All statistical analyses were performed with Stata statistical software, version SE 9.2⁽¹⁵⁾.

To investigate the association between exposure to a specific nutrition information source (binary predictor) and daily FV consumption (binary outcome), controlling for potential confounding factors, multiple logistic regression models were used. Potential confounding factors were a priori selected on the basis of previous findings described in the literature and included age, gender, ethnicity, salary and BMI (model 1). Model 2 included, in addition, the lifestyle factors, smoking and the measure for sedentary behaviour.

The OR and corresponding 95% CI was calculated for the adjusted effect of exposure to each nutrition information source on daily FV consumption of the subjects. An OR greater than one indicates how much more likely it is that someone who is exposed to a specific nutrition

information source will eat FV daily, as compared to someone who is not exposed. If the OR is less than one, then daily FV consumption is less likely. OR is one when there is no association^(16,17). All regression models were tested for model assumptions and fit. No significant interaction was found for the main subgroup-specific regression coefficients, particularly for ethnicity on nutrition information sources.

The χ^2 test was used to test for associations between categorical variables. All significance levels quoted are two-sided. All analyses excluded respondents with missing values and subjects older than 23 years.

Results

Sociodemographic, anthropometric and lifestyle characteristics (daily FV consumption, smoking and sedentary behaviour) of the study sample are described in Table 1. About a quarter of the participants were of non-Austrian ethnicity (12% from Balkan states, 8% Turks and 4% other). Compared to boys, girls had a lower mean BMI (20.8 *v.* 22.3 kg/m²; $P < 0.001$), reported more frequently daily FV consumption (fruit: 36% *v.* 32%; $P = 0.02$ and vegetables: 25% *v.* 21%; $P = 0.03$) and reported less frequently sedentary behaviour (TV viewing or personal computer use) for more than 4 h/d (13% *v.* 17%; $P < 0.001$). However, the proportion of daily smokers was higher among girls (68% *v.* 63%; $P = 0.005$).

TV was the most often-reported nutrition information source of adolescents, irrespective of gender and ethnicity. More than twice as many girls than boys reported magazine articles and booklets as their preferred nutrition information source. TV, school, newspapers and booklets were more frequently reported as a nutrition information source among non-Austrians than Austrians, whereas radio and magazines were highly rated among Austrians. There was no difference regarding the Internet as a nutrition information source by gender and ethnicity (Table 2). A total of 6% of the participants reported that they do not look for any information on nutrition at all (4% girls and 7% boys, $P < 0.001$).

The OR in Table 3 demonstrate the association between exposure to a specific nutrition information source and daily FV consumption, controlling for potential confounders. Adolescents who reported exposure to booklets as a nutrition information source were almost 70% more likely to eat FV daily than adolescents who did not refer to booklets. Exposure to the Internet as a nutrition information source increased the probability of daily FV consumption by 59% and 47% respectively. Newspaper articles as a nutrition information source were also positively associated with daily FV consumption. Exposure to magazine articles increased the probability of daily fruit consumption by 25%. However, there was no evidence for an association with daily vegetable

Table 2 Nutrition information sources of adolescents by gender and ethnicity (*n* 2949)

Source	Girls		Boys		Non-Austrian		Austrian		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
TV programmes	690**	49	653	43	368*	49	955	44	1343	46
Relatives/friends	677**	48	645	43	350	47	950	44	1322	45
School	507*	36	484	32	298***	40	684	32	991	34
TV commercials	352	25	407	27	215*	29	535	25	759	26
Magazine articles	493***	35	260	17	168*	23	576	27	753	26
Booklets	447***	31	219	14	199***	27	455	21	666	23
Newspaper articles	294	21	287	19	166*	22	409	19	581	20
Radio programmes	249	17	244	16	95***	13	392	18	493	17
The Internet	210	15	223	15	115	15	314	15	433	15
Magazine ads	180***	13	119	8	68	9	228	11	299	10
Radio commercials	118*	8	165	11	65	9	215	10	283	10
Newspaper ads	110	8	134	9	73	10	170	8	244	8

Multiple responses were possible; *n* 2913 for ethnicity.

P* < 0.05; *P* < 0.01; ****P* < 0.001 (χ^2 test for testing significant differences between girls and boys and non-Austrians and Austrians, respectively).

Table 3 OR and 95% CI for daily fruit and vegetable consumption associated with exposure to a specific nutrition information source among adolescents (*n* 2949), controlling for age, gender, ethnicity, salary and BMI

Source	Fruit			Vegetables		
	OR	95% CI	<i>P</i> value	OR	95% CI	<i>P</i> value
TV programmes	0.95	0.81, 1.11	0.52	0.89	0.74, 1.08	0.23
TV commercials	0.90	0.75, 1.08	0.26	0.81	0.65, 1.00	0.051
Radio programmes	1.07	0.87, 1.33	0.52	0.96	0.75, 1.22	0.73
Radio commercials	0.74	0.56, 0.99	0.041	0.67	0.48, 0.95	0.025
Newspaper articles	1.31	1.07, 1.59	0.008	1.36	1.09, 1.69	0.006
Newspaper ads	0.89	0.66, 1.19	0.44	0.84	0.59, 1.18	0.32
Magazine articles	1.25	1.04, 1.50	0.019	1.12	0.91, 1.38	0.29
Magazine ads	1.07	0.83, 1.40	0.59	1.10	0.82, 1.47	0.54
Booklets*	1.67	1.38, 2.02	<0.001	1.69	1.37, 2.09	<0.001
The Internet	1.59	1.28, 1.98	<0.001	1.47	1.15, 1.87	0.002
Relatives/friends	1.00	0.85, 1.18	0.99	0.98	0.82, 1.18	0.83
School	1.09	0.92, 1.29	0.33	1.01	0.83, 1.23	0.93

*Disseminated mainly through health professionals and schools.

consumption. Adolescents who reported advertisements as their nutrition information source were less likely to eat FV daily. Particularly, exposure to radio commercials decreased the probability of daily FV consumption by 26% and 33%, respectively. Exposure to TV commercials was negatively associated with daily vegetable consumption, but not with fruit consumption. There was no association between daily FV consumption and exposure to nutrition information provided by relatives/friends, TV and radio programmes, and at school. Exclusion of non-Austrians from analyses had no substantial effect on OR (<10%).

In the fully adjusted model 2, the estimates were essentially unchanged except for the association between exposure to TV commercials and daily FV consumption. The OR changed to 0.92 (95% CI 0.76, 1.12; *P* = 0.40) for daily fruit consumption and to 0.85 (95% CI 0.68, 1.06; *P* = 0.15) for daily consumption of vegetables.

Lifestyle characteristics (included as covariates in model 2) were independently associated with daily FV consumption. Adolescents who smoked and spent more

than 4 h/d in front of the TV or personal computer were less likely to eat FV daily (data not shown).

Discussion

Improved understanding of factors that influence adolescents' FV consumption may guide public health interventions to promote intake.

The findings of the present study suggest that exposure to specific types of mass media as sources of nutrition information may influence FV consumption among adolescents to a different degree and direction. Essentially, those adolescents were more likely to eat fruits daily who reported exposure to nutrition information provided by booklets, the Internet and newspaper and magazine articles. Similar results were found for daily vegetable consumption, except for magazine articles, where no association with daily consumption was evident. On the other hand, exposure to radio and TV commercials decreased the likelihood of daily FV consumption. No associations were found for exposure

to newspaper and magazine ads. Nutrition information broadcast on TV and radio programmes was not associated with daily FV consumption. Neither was nutrition information provided at school and by friends/relatives.

Which potential mechanisms may explain the influence of specific nutrition information sources on FV consumption among adolescents?

Consider a 'healthy eating' slogan to which an adolescent is exposed (e.g. 'Eat 5 FV a Day'). Applying the simplified model of consumer research as a theoretical framework⁽¹⁴⁾, likelihood of exposure is increased if the adolescent is interested in healthy eating and actually searches for the information. However, exposure may also be incidental (e.g. advertisements). Subsequent behaviour may be affected by how the information is perceived, either consciously or subconsciously, with stronger effects when perception happens consciously. If perception leads to understanding and liking of the information, the 'healthy eating' slogan may finally be used in making choices.

Adolescents who reported exposure to booklets, the Internet and newspaper and magazine articles as a nutrition information source, are probably more interested in nutrition-related topics and actively seek them out. In contrast, nutrition information disseminated through TV and radio (particularly advertisements), schools and relatives/friends does not necessarily require active search to achieve exposure. All in all, active search and interest in nutrition-related topics might influence subsequent behaviour to a stronger degree.

Two other important characteristics of nutrition information sources are the quality of their content (in terms of objectivity and scientific soundness) and credibility of the source.

There is not much literature available regarding content quality of nutrition-related information covered in mass media. In the case of booklets, which are disseminated through pharmacies, general practitioners and other health professionals, the nutrition information provided may be regarded as coherent and congruent with dietary guidelines.

The quality of nutrition information covered in newspaper and magazine articles is probably more variable and depends highly on the type of publication^(18,19).

The Internet is also highly variable in terms of objectivity and quality. A study from Canada that analysed the content of websites most used to access nutrition information found that information about FV was not always consistent. However, information congruent with FBDG was found three times more often than incongruent information⁽²⁰⁾. Content analyses of Austrian websites revealed that 40% of the identified sites that covered nutrition information provided information congruent with FBDG, 38% were more or less congruent and 22% were incongruent⁽⁴⁾.

It has been described that only few TV newscasts provide useful information about health and nutrition and many reports were hard to understand^(19,21). A content

analysis of nutrition-related information presented on American prime-time network programmes for children showed only minor congruence with FBDG. Only 14% and 9%, respectively, of all food referenced on TV were FV, whereas 43% were fats, sweets and alcohol⁽²²⁾. Radio programmes likely are not very different in that regard.

Nutrition information provided by friends/relatives is probably the most variable and also highly subjective. This is confirmed by looking at credibility rankings, where only 5% of Americans name friends/family as a believable source of health and nutrition information. Nutrition information provided at schools may be more congruent with dietary guidelines; however, credibility (2% of Americans) seems to be even lower than with friends/family. The most believable sources of health and nutrition information were reported to be medical sources (36%), followed by the mass media (24%) and the Internet (15%)⁽¹²⁾. Among European adolescents and adults, medical sources are also the top believable sources ('fully trusted or tended to trust': 91%). They are followed by government agencies and food packages; TV/radio ranks fourth (61%), followed by newspapers/magazines (56%) and advertising (25%)⁽¹¹⁾. However, in the aforementioned study, the vast majority of participants were older than 24 years of age.

When asked to rate specific sources that influence dietary habits, Americans rated health professionals as the most influential (up to 84% cited to either a 'moderate' or 'great' extent). The Internet was rated as having an impact of 58%, followed by TV news programmes (54%) and magazine and newspaper articles (53% and 44%, respectively)⁽¹²⁾.

Despite TV/radio (programmes), relatives/friends and school being reported the top three sources of nutrition information for adolescents, they were not associated with FV consumption. Disliking and/or misunderstanding due to poor content quality and/or low credibility of nutrition information covered in these sources may explain these findings.

The negative impact of TV and radio commercials on FV consumption among adolescents in the present study was as expected. TV commercials with their heavy marketing of foods with little aimed at FV may have an influence on eating habits by shaping nutritional beliefs and attitudes of young people^(8,10). A review of the literature reported that children exposed to food advertising will choose advertised foods at significantly higher rates than children who were not exposed⁽⁹⁾. A high proportion of the foods advertised were usually foods representing the fats and sweets food group⁽²³⁾. Powell *et al.* reported that 89.4% of food advertisements viewed by adolescents were high in fat, sugar or sodium⁽²⁴⁾. This uneven marketing may encourage young people to replace FV with other foods⁽⁸⁾. Additionally, half of the food advertisements on TV implied healthful qualities of the foods⁽²⁵⁾.

The fact that advertisements covered in newspapers and magazines showed no effect on FV consumption may

be explained by the less frequent and probably less persuasive exposure to these media.

For the interpretation of the present findings, several limitations have to be acknowledged.

Exposure to nutrition information sources was rather crudely measured. Adolescents were only asked to name their usual source(s) (with multiple responses allowed), including advertisement channels. More detailed and better-validated measures would very likely have improved estimations of actual effects by decreasing measurement error.

Although we controlled for several confounders regarding FV consumption, it is likely that unmeasured factors may have distorted the tested associations.

The sample of the present study consisted of adolescents in vocational training (representing about 30% of adolescents in Austria), a population group with riskier lifestyles; thus, generalisation of the results should only be done with caution.

The present study contributes to the literature on determinants of FV consumption. The findings suggest that nutrition information matters, as does the source that conveys the information. Greater attention to mass media sources of nutrition information for adolescents should be encouraged. Dissemination of 'healthy eating' slogans may then emphasise sources with bigger and the desired impact in communicating nutrition information to adolescents.

However, for consumers, the distinction between food ads and 'healthy eating' slogans may not always be clear (e.g. use of health claims for marketing reasons), particularly when disseminated through mass media.

Future studies should examine content quality of nutrition-related information covered in mass media, particularly Internet websites and articles in newspapers and magazines, and its association with dietary behaviour. Another research question concerns the amount and frequency of exposure if there is a threshold effect on dietary behaviour.

Conclusions

Newspaper articles, the Internet and booklets as a source of nutrition information are positively associated with daily FV consumption among adolescents, whereas radio ads have a negative impact. Dissemination of 'healthy eating' slogans should make use of print media and the Internet. Finally, future studies should pay attention to food ads on the radio and their effects on dietary intake.

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